

What is claimed is:

1. An image synthesizing method of synthesizing an actual scene image and a computer-graphics image, comprising steps of:

extracting a designated region from the actual scene image;

appending three-dimensional shape information to the extracted region; and

constructing a computer-graphics model representing information relating to said extracted region on the basis of information of said extracted region and said three-dimensional shape information.

2. An image synthesizing method according to claim 1, further comprising a step of synthesizing the computer-graphics model representing the information relating to said extracted region with another computer-graphics model for compound display.

3. An image synthesizing method according to claim 1, wherein

the steps in claim 1 are performed for a plurality of frames constituting the actual scene image.

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a means for performing 4-connected or 8-connected labeling with each of the designated pixels as the starting point;

a means for changing non-labeled regions to non-extracted regions; and

a means for calculating an optical features of said extracted region,

and for the next frame,

a means for labeling;

a means for calculating an optical features for each of regions assigned different labels; and

a means for keeping, as the extracted region, a region having an optical features close to the optical features of said extracted region in the preceding frame, and changing other regions to non-extracted regions.

¹
~~37~~. A method of displaying a three-dimensional shape model onto a two-dimensional plane, characterized in that a regular polyhedron containing therein whole or a part of the three-dimensional shape model is also displayed.

²
~~38~~. A method of displaying a three-dimensional shape model according to claim ~~37~~¹, wherein said polyhedron is translucent.

^{3.}
~~39.~~ A method of displaying a three-dimensional shape model according to claim ~~38~~², wherein

the color of said polyhedron is determined on the basis of the background color of the two-dimensional plane and on the color of the three-dimensional shape model.

^{4.}
~~40.~~ A method of displaying a three-dimensional shape model according to claim ~~37~~¹, wherein

display mode of said three-dimensional shape model is changed in accordance with a relative positional relationship between a point designated by a pointing device and the position of the polyhedron.

^{5.}
~~41.~~ An apparatus for displaying a three-dimensional shape model onto a two-dimensional plane, comprising:

a means for calculating a regular polyhedron containing therein whole or a part of the three-dimensional shape model;

a pointing device;

a means for judging a relative positional relationship between a point designated by the pointing device and the position of said polyhedron; and

a means for changing display mode of said three-dimensional shape model in accordance with the result of the judgment.

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4. An image synthesizing method according to claim 2,
wherein

the steps in claim 2 are performed for a plurality of frames constituting the actual scene image.

5. An image synthesizing apparatus for synthesizing an actual scene image with a computer-graphics image, comprising:

a means for extracting a designated region from the actual scene image;

a means for appending three-dimensional shape information to the extracted region; and

a means for constructing a computer-graphics model representing information relating to said extracted region on the basis of information of said extracted region and said three-dimensional shape information.

6. An image synthesizing apparatus according to claim 5, further comprising

a means for synthesizing the computer-graphics model representing the information relating to said extracted region with another computer-graphics model for compound display.

7. A method of extracting a three-dimensional shape of

an object contained in an actual scene image, comprising the steps of:

preparing data of a plurality of geometric shapes beforehand;

extracting a region corresponding to said object from the actual scene image;

selecting one of the geometric shapes and displaying the selected shape on a screen where the extracted region is displayed; and

adjusting the position, orientation, and size of said shape to make said shape coincide with said extracted region.

8. An apparatus for extracting a three-dimensional shape of an object contained in an actual scene image, comprising steps of:

a means for preparing data of a plurality of geometric shapes beforehand;

a means for extracting a region corresponding to said object from the actual scene image;

a means for selecting one of the geometric shapes and displaying the selected shape on a screen where the extracted region is displayed; and

an adjusting means for adjusting the position, orientation, and size of said shape to make said shape coincide

with the extracted region.

9. A three-dimensional shape extraction apparatus according to claim 8, wherein

said adjusting means includes a means for automatically making the adjustments on the basis of the shape of said object in the actual scene image.

10. A three-dimensional shape extracting apparatus according to claim 8, further comprising

a means for mapping image information of said extracted region onto surfaces of the shape adjusted by said adjusting means, and for displaying the mapped result.

11. A method of extracting a designated region from an image, comprising steps of:

designating a plurality of pixels within a region to be extracted;

calculating a predetermined features for the designated pixels;

calculating a maximum value and a minimum value of the calculated features;

calculating features for pixels inside and outside the region to be extracted; and

selecting pixels whose features are between said

maximum value and said minimum value,

wherein a region made up of the selected pixels is designated as an extracted region.

12. A region extracting method according to claim 11, further comprising steps of:

assigning a value to the pixels in said extracted region and a different value to the pixels in non-extracted regions; and

assigning an intermediate value between said two values to pixels located along an outer edge of the boundary of said extracted region,

wherein an image is generated by using these assigned values.

13. A method of extracting a designated region from an image, comprising steps of:

designating a plurality of pixels within a region to be extracted;

calculating a prescribed features for the designated pixels;

calculating a difference in the calculated features between adjacent pixels within the designated pixels;

calculating a maximum value of the calculated difference; and

connecting four connected pixels or eight connected pixels of which the difference in the features between adjacent pixels is smaller than said maximum value, with each of the designated pixels as a starting point,

wherein a region made up of the thus connected pixels is designated as an extracted region.

14. A region extracting method according to claim 13, further comprising steps of:

assigning a value to the pixels in said extracted region and a different value to the pixels in non-extracted regions; and

assigning an intermediate value between said two values to pixels located along an outer edge of the boundary of the extracted region,

wherein an image is generated by using these assigned values.

15. A region extracting method according to claim 12, further comprising a step of

assigning individually different intermediate values to a plurality of pixels adjacent each other along a direction moving farther from said extracted region.

16. A region extracting method according to claim 14,

further comprising a step of

assigning individually different intermediate values to a plurality of pixels adjacent each other along a direction moving farther from said extracted region.

17. A method of extracting a designated region from an image, comprising steps of:

designating a plurality of pixels within a region to be extracted;

calculating a predetermined features for the designated pixels;

calculating a maximum value and a minimum value of the calculated features;

calculating features for pixels inside and outside the region to be extracted;

determining whether the calculated features are within a range between said maximum value and said minimum value;

assigning a constant K to the pixels within said range;

calculating the difference between the features of the pixels outside the range and said maximum value or said minimum value; and

assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined as a function of said difference,

wherein an image is generated by using these assigned

19. A method of extracting a designated region from an image, comprising steps of:

designating a plurality of pixels within a region to be extracted;

calculating a predetermined features for the designated pixels;

calculating a mean and a variance of the calculated features;

calculating features for pixels inside and outside the region to be extracted;

determining whether the calculated features are within a range defined by said mean and said variance;

assigning a constant K to the pixels within said range;

calculating a deviation of the features of the pixels outside said range with respect to said mean; and

assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined in relation to said deviation,

wherein an image is generated by using these assigned values.

20. A method of extracting a designated region from an image, comprising steps of:

designating a plurality of pixels within a region to be

extracted;

calculating a plurality of prescribed features for the designated pixels;

calculating a mean and a variance of each of the calculated features;

calculating features for pixels inside and outside the region to be extracted;

determining whether each of the calculated features is within a range defined by said mean and said variance;

assigning a constant K to the pixels within said range;

calculating a deviation of each features of the pixels outside said range with respect to said mean; and

assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined in relation to said deviation of each of the features,

wherein an image is generated by using these assigned values.

21. A method of extracting a designated region from an image, comprising steps of:

designating a plurality of pixels within a region to be extracted;

performing 4-connected or 8-connected labeling with each of the designated pixels as the starting point; and

changing non-labeled regions to non-extracted regions.

22. A method of extracting a designated region from an image consisting of a plurality of frames, comprising steps of:

for one frame,

designating a plurality of pixels within a region to be extracted;

performing 4-connected or 8-connected labeling with each of the designated pixels as the starting point;

changing non-labeled regions to non-extracted regions; and

calculating a geometric features of the extracted region,

and for the next frame,

performing labeling;

calculating a geometric features for each of regions assigned different labels; and

keeping, as the extracted region, a region having a geometric features close to the geometric features of the extracted region in the preceding frame, and changing other regions to non-extracted regions.

23. A method of extracting a designated region from an image consisting of a plurality of frames, comprising steps

of:

for one frame,
designating a plurality of pixels within a region to be extracted;
performing 4-connected or 8-connected labeling with each of the designated pixels as the starting point;
changing non-labeled regions to non-extracted regions;
and
calculating an optical features of the extracted region,
and for the next frame,
performing labeling;
calculating an optical features for each of regions assigned different labels, and
keeping, as the extracted region, a region having an optical features close to the optical features of the extracted region in the preceding frame, and changing other regions to non-extracted regions.

24. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a region to be extracted;
a means for calculating a predetermined features for the designated pixels;

a means for calculating a maximum value and a minimum value of the calculated features;

a means for storing the calculated maximum value and minimum value;

a means for calculating features for pixels inside and outside the region to be extracted, and for selecting pixels whose features are between said maximum value and said minimum value,

wherein a region made up of the selected pixels is designated as an extracted region.

25. A region extracting apparatus according to claim 24, further comprising:

a means for assigning a value to the pixels in said extracted region and a different value to the pixels in non-extracted regions; and

a means for assigning a value intermediate between the above two values to pixels located along an outer edge of the boundary of said extracted region,

wherein an image is generated using these assigned values.

26. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a

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region to be extracted;

a means for calculating a predetermined features for the designated pixels;

a means for calculating a difference in the calculated features between adjacent pixels within the designated pixels;

a means for calculating a maximum value of the calculated difference;

a means for storing the calculated maximum value; and

a means for connecting, with each of the designated pixels as the starting point, four connected pixels or eight connected pixels for which the difference in the features between adjacent pixels is smaller than said maximum value,

wherein a region made up of the thus connected pixels is designated as an extracted region.

27. A region extracting apparatus according to claim 26, further comprising:

a means for assigning a value to the pixels in said extracted region and a different value to the pixels in non-extracted regions; and

a means for assigning an intermediate value between said two values to pixels located along an outer edge of the boundary of said extracted region,

wherein an image is generated by using these assigned

values.

28. A region extracting apparatus according to claim 25, further comprising

a means for assigning individually different intermediate values to a plurality of pixels adjacent each other along a direction moving farther from said extracted region.

29. A region extracting apparatus according to claim 27, further comprising

a means for assigning individually different intermediate values to a plurality of pixels adjacent each other along a direction moving farther from said extracted region.

30. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a region to be extracted;

a means for calculating a predetermined features for the designated pixels;

a means for calculating a maximum value and a minimum value of the calculated features;

a means for storing the calculated maximum value and minimum value;

a means for calculating features for pixels inside and

outside the region to be extracted, and for determining whether the calculated features are within a range between said maximum value and the minimum value;

a means for assigning a constant K to the pixels within said range;

a means for calculating the difference between the features of the pixels outside said range and the maximum value or the minimum value; and

a means for assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined in relation to said difference,

wherein an image is generated by using these assigned values.

31. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a region to be extracted;

a means for calculating a plurality of predetermined features for the designated pixels;

a means for calculating a maximum value and a minimum value of each of the calculated features;

a means for storing the calculated maximum value and minimum value;

a means for calculating features for pixels inside and

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outside the region to be extracted, and for determining whether each of the calculated features is within a range between said maximum value and said minimum value;

a means for assigning a constant K to the pixels within said range;

a means for calculating the difference between each features of the pixels outside said range and said maximum value or said minimum value; and

a means for assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined in relation to said difference of each of the features,

wherein an image is generated by using these assigned values.

32. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a region to be extracted;

a means for calculating a predetermined features for the designated pixels;

a means for calculating a mean and a variance of the calculated features;

a means for storing the calculated mean and variance;

a means for calculating features for pixels inside and

outside the region to be extracted, and determining whether the calculated features are within a range defined by said mean and variance;

a means for assigning a constant K to the pixels within said range;

a means for calculating a deviation of the features of the pixels outside said range with respect to said mean; and

a means for assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined in relation to said deviation,

wherein an image is generated by using these assigned values.

33. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a region to be extracted;

a means for calculating a plurality of predetermined features for the designated pixels;

a means for calculating a mean and a variance of each of the calculated features;

a means for storing the calculated mean and variance;

a means for calculating features for pixels inside and outside said region to be extracted, and for determining whether each of the calculated features is within a range

defined by said mean and said variance;

a means for assigning a constant K to the pixels within said range;

a means for calculating a deviation of each features of the pixels outside said range with respect to said mean; and

a means for assigning to the pixels outside said range a value calculated by subtracting from the constant K a value determined in relation to said deviation of each of the features,

wherein an image is generated by using these assigned values.

34. An apparatus for extracting a designated region from an image, comprising:

a means for designating a plurality of pixels within a region to be extracted;

a means for performing 4-connected or 8-connected labeling with each of the designated pixels as the starting point; and

a means for changing non-labeled regions to non-extracted regions.

35. An apparatus for extracting a designated region from an image consisting of a plurality of frames, comprising:

for one frame,

a means for designating a plurality of pixels within a region to be extracted;

a means for performing 4-connected or 8-connected labeling with each of the designated pixels as the starting point;

a means for changing non-labeled regions to non-extracted regions; and

a means for calculating a geometric features of said extracted region,

and for the next frame,

a means for labeling;

a means for calculating a geometric features for each of regions assigned different labels; and

a means for keeping, as the extracted region, a region having a geometric features close to the geometric features of said extracted region in the preceding frame, and for changing other regions to non-extracted regions.

36. An apparatus for extracting a designated region from an image consisting of a plurality of frames, comprising:

for one frame,

a means for designating a plurality of pixels within a region to be extracted;

42. A method of generating an image sequence consisting of a plurality of frames by synthesizing an image managed in units of frames and a computer-graphics image, characterized in that

the image is synthesized with the computer-graphics image by using synthesis data that contains image data defining the image and specifications of the image, data defining an object to be displayed by computer graphics and an image to be pasted on a surface thereof, and information of display time of said object.

43. An image sequence generating method according to claim 42, wherein

the object display time information contained in said synthesis data carries the time of a synthetic image, the time at which the playback of the image to be pasted on the surface of the object to be synthesized is started, and the starting frame number of the image.

44. An image sequence generating method according to claim 43, wherein

the frame of the image to be pasted at each time is determined on the basis of the time information contained in said/synthesis data.

45. An image sequence generating method according to claim 43, wherein

image synthesis processing is adjusted in time on the basis of the time information contained in said synthesis data.

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